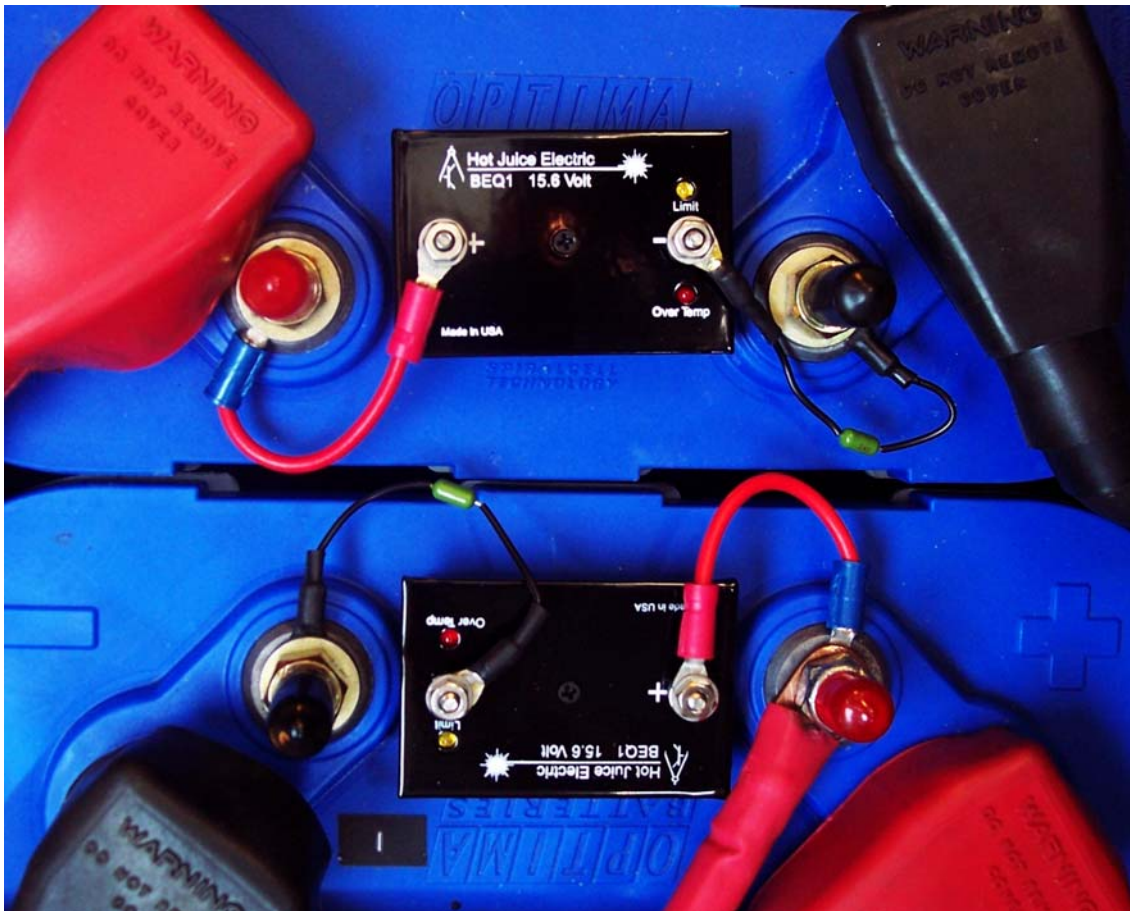
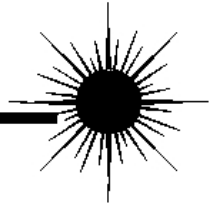




Hot Juice Electric

BEQ1 Manual



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For best results, please read this manual and all applicable supplements completely before installation.

Table of Contents:

How does the BEQ1 work?..... Page 1
BEQ1 Operation..... Page 1
Installing the BEQ1's Page 2-3
Removing the BEQ1 Page 3
Specifications Page 4
Warranty Page 5

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The **BEQ1** is a rugged, simple to use, economical shunt regulator that is designed to keep a series string of AGM batteries equalized by enhancing the recombinant charging phase. Instead of focusing on battery voltage or State Of Charge, the BEQ1 regulates the battery State Of Condition.

How does the BEQ1 work?

With AGM batteries, a higher terminal voltage does not necessarily indicate a higher State Of Charge or capacity. Clamping the voltage at a predetermined "full" voltage level does not necessarily ensure all the batteries in the string are actually "equal".

The object of the BEQ1 is to equalize the batteries State Of Condition. The BEQ1 is not a "brute force" voltage regulator; in fact it is not really intended to regulate voltage. It is designed to operate in the recombine pulse phase of charging. Therefore, the BEQ1 is designed for AGM batteries charged with chargers that incorporate a Constant Current / Pulse Finish charger profile.

AGM batteries are sealed with the electrolyte absorbed in a glass mat that is squeezed very tight between the lead plates. Therefore, they must not vent gas or air pockets will form in the glass mat causing a loss of capacity. AGM batteries use a catalyst technology to recombine the gasses to prevent that loss. The recombination however occurs after a full bulk charge and with a low current high voltage final charge. The recombinant process is most effective when the voltage has reached approximately 2.6 volts per cell (15.6 Volts for 12 a volt battery), then is released. The recombination occurs while the voltage is dropping back down to the resting voltage. This process repeats continuously with a pulse ON for about one second and OFF for about five seconds. That is why the pulse charge is most effective. The efficiency of the process degrades when the voltage exceeds 2.7 volts per cell (16.2 volts for 12 volt battery). The role of the BEQ1 is to reduce, but not eliminate, the pulse current in batteries over 15.6 volts. If it eliminated the current then that battery would not receive the full recombination process. This method has proven to be very effective in maintaining AGM battery condition and equalization. Some test results can be seen here: http://www.hotjuiceelectric.com/beq1_test_results.html

BEQ1 Operation

When the voltage across a battery exceeds the BEQ1 voltage set point, it will turn on and conduct a portion of the charging amps. The yellow **LIMIT** LED on the BEQ1 will illuminate indicating the BEQ1 is on. At no time should all BEQ1s be on at the same time. This would indicate the wrong BEQ1s are installed or the charge voltage is in error or all batteries in the pack have excessive impedance. To illustrate, if all batteries in the pack were in absolute perfect balance (within 0.09 volts), then no BEQ1 would turn on. Normally, about half the pack will have turned on BEQ1s.

The red **OVER TEMP** LED will illuminate if the BEQ1 temperature exceeds 100° C. This can occur if:

- The battery's impedance is too high (bad battery or loose battery terminal).
- The State of Charge of another battery(s) in the string is too low compared to the rest of the batteries in the string.
- Another battery(s) in the string has a shorted cell.
- Insufficient airflow around the BEQ1.

Once tripped, the **OVER TEMP** circuit reduces the shunt current and is latched on until the voltage drops below the BEQ1's set point. This means the charger should be turned down or off until the cause of over heating is determined.

Installing the BEQ1's

Warning! Ensure the battery pack disconnect is Open! If the pack does not have a safety disconnect, remove and tape a battery terminal in the center of the pack. Always remember, Safety First!

1. Confirm placement of the BEQ1 module on a flat visible surface. The location should be as close to the battery terminals as possible and well ventilated. **Do not mount the BEQ1 at this time.**
2. Install the connection leads on the BEQ1 as shown in **Fig. 1**.
 - Connect the Red lead to the positive (+) terminal.
 - Connect the black lead, with the in-line fuse*, to the negative (-) terminal.
 - Note the order of washers, ring terminal and nut. See **Fig.1**.
 - **CAUTION:** the bottom nut (See **Fig.1**) must never be loosened. Internal damage may result.
 - Ensure that the smooth sides of the washers face the ring terminal.
 - At this point, the nut should be screwed on but not tight. You should be able to easily move the terminal leads around.
3. Clean the mounting area with denatured alcohol or appropriate cleaner that does not leave a residue.
4. Peel the protective cover from the adhesive mounting square on the bottom of the BEQ1 and press the BEQ1 onto the mounting surface.
5. Connect the BEQ1 lead ring terminals to the battery terminals.
 - If the battery terminals are automotive posts, the ring terminals can be placed under the clamp nut.
 - If the battery uses female screw terminals, the ring terminal can be placed under the bolt head.
6. **Refer to Fig 2.** Using a ¼" hex nut driver with a small diameter handle, tighten the BEQ1 terminal nuts.
 - **CAUTION:** It is important to hold the terminal lead while tightening the nut to ensure proper placement of the lead and to avoid excessive torque applied to the terminal stud. (See **Fig. 2**)
 - Do not over tighten the nut. It should be finger tight.
 - Re-check tightness after a few days. The nut should stay tight after the first re-tightening.
7. Repeat steps 1 through 6 for all batteries in the pack.

IMPORTANT! Periodic voltage checks at the BEQ1 terminals will confirm connection and the fuse condition for each BEQ1. A blown fuse will result in zero volts across the BEQ1 terminals. A blown fuse indicates the voltage across the BEQ1 has exceeded its maximum rated terminal voltage or the voltage across the BEQ1 has been reversed.

* The in-line fuse is required. Connecting the BEQ1 improperly can blow the fuse. Omitting the fuse can cause permanent damage to the BEQ1. Replacement fuses are available from **Hot Juice Electric**.

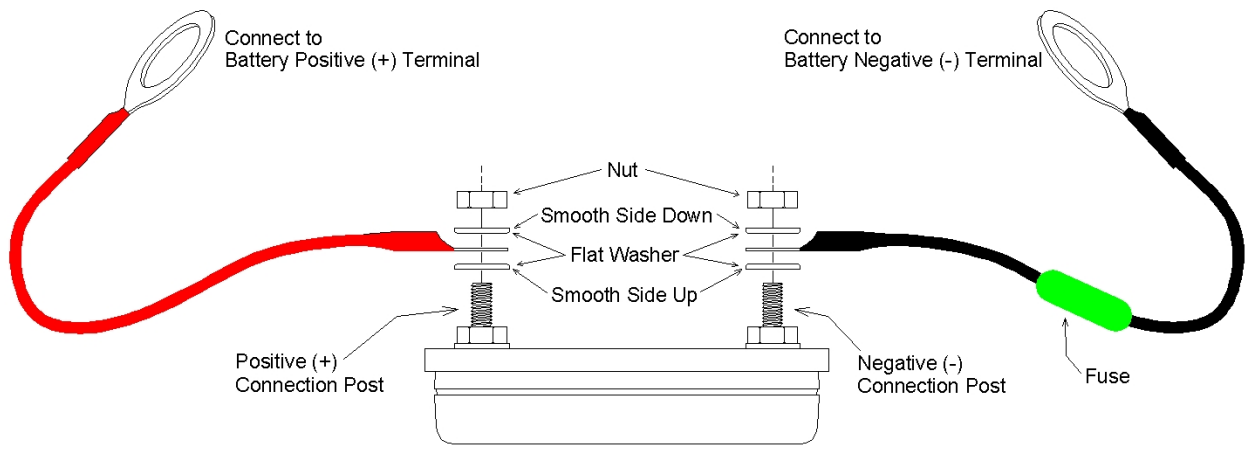


Figure 1



Figure 2

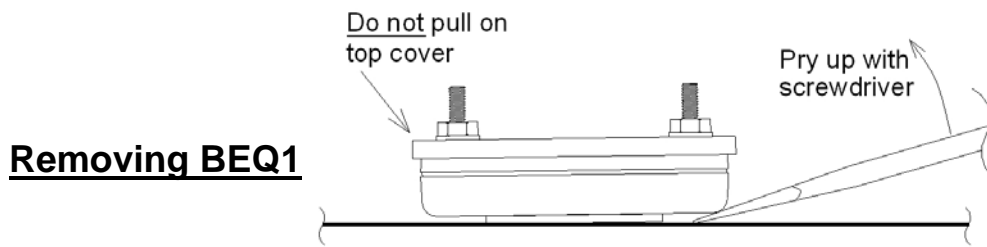


Figure 4

Specifications:

6 Volt

12 Volt

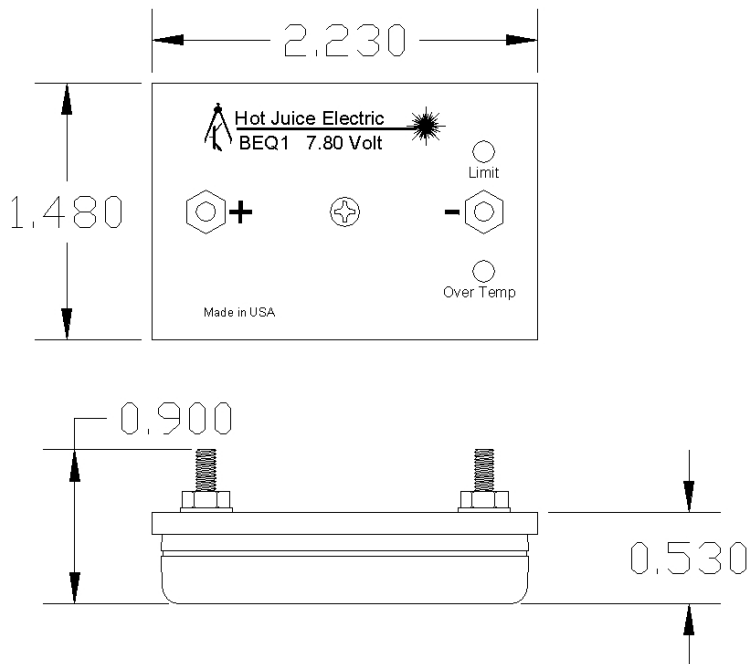
Absolute Maximum Ratings:

Max Terminal Voltage +10 Volts +20 Volts
Max Reverse Terminal Voltage -0.45 Volts -0.45 Volts
Max Operating Temperature +125° C +125° C
Max Current during Over Temp 400mA 140 mA
Minimum Operating Temperature -40° C -40° C

Electrical Characteristics:

Turn ON voltage 7.850 Volts 15.665 Volts
Turn OFF Voltage 7.754 Volts 15.534 Volts
Shunt Current 3.2 Amps 1.5 Amps
Quiescent Current 300 μ A 300 μ A
Over Temp Limit Trip Temperature +100° C +100° C

Dimensions:



Limited Warranty:

Hot Juice Electric, Ilc warrants that this product is free from defects in materials or workmanship for a period of two years from the date of purchase. During the warranty period, and upon proof of purchase, the product will be repaired or replaced without charge. This warranty shall not apply if the product is modified, tampered with, misused, or subjected to abnormal working conditions.

The circuits contained in **Hot Juice Electric, Ilc** products are proprietary. Purchase of these products does not transfer any rights or grant any license to the circuits used in these products. Disassembling is explicitly prohibited. There are no user-serviceable parts inside. Removing the cover, tampering with, modifying, or repairing will automatically void the warranty. **Hot Juice Electric, Ilc** is not responsible for any consequential damages.

To obtain warranty, please contact

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